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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

ARTMAN, THOMAS R

ART UNIT PAPER NUMBER

2882

DATE MAILED: 10/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/836,029

Applicant(s)

BYERS ET AL.

Examiner

Thomas R Artman

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1-2 are rejected under 35 U.S.C. 102(e) as being anticipated by Miracky (US 2002/0105699).

Regarding claim 1, Miracky has the structure in Fig.12A and as described in paragraph 0095, including 1) a first circuit board (item 555A), 2) a second circuit board (item 555B) adjacent to the first circuit board, 3) a light source coupled to the first circuit board that is adapted to transmit an optical signal (item 565A), 4) a photodetector (item 575A) coupled to the second circuit board, where the circuit boards are arranged such that the photodetector receives light from the light source over an optical transport medium.

With respect to claim 2, Miracky's optical transport medium is free space.

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-12 and 14-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miracky (US 2002/0105699) and in view of Jewell (US 6,421,474).

With regards to claim 3, Miracky's optical transport medium is free space, and he does not teach of the use of a light pipe. Jewell demonstrates the use of light pipes in Fig.16, including optical fibers (item 32) and lenses and spacer elements (items 12 and 14) that are used to properly couple the optical signal into or out of the devices on the circuit board. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a light pipe, or some sort of waveguide, in order to ensure proper optical alignment of the two circuit boards to improve optical coupling between the devices. Also, the optical signal is transmitted without possible attenuation or scattering due to impurities in air, such as dust (free space).

With respect to claim 4, the structure as applied above against claim 3 applies here and the following. Jewell also discloses a ferrule (Fig.16, item 82) that is connected to the light pipe. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a ferrule to connect a light pipe to the light source. Ferrules and other connections are quite common and for good reason: these structures provide a means for properly aligning light pipes and related structures for maximum efficiency of light coupling between optical devices and waveguides.

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With regards to claim 9, the structure as applied above against claim 4 applies here and the following. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a cylindrical, plastic light pipe. Cylindrical plastic light pipes are easily formed and cheap due to being made of plastic. Their use is as common as indicator lights in computers. The power light and hard drive indicator light on the front of personal PC computer housings often use plastic, typically cylindrical, waveguides to channel the light from the LED on the circuit board to the holes cut into the front of the outer housing. The plastic waveguides are cheap, simple to manufacture, and are resilient to mechanical use, as in removing the outer housing for repairs, etc. In the present application of using plastic light pipes for optically connecting mezzanine circuit boards to the main board, the circuit boards will be added to and removed from the main circuit board, perhaps several times for repairs, upgrades, etc., by technicians as well as individual owners of the hardware. These plastic waveguides, as opposed to glass for example, serve as a time-tested economical solution for the need of mechanically resilient waveguides.

With respect to claim 14, the structure as applied above against claim 4 applies here and the following. It would have been obvious to one of ordinary skill in the art at the time the invention was made that all ferrules have physical wells for a receiving structure to fit into the well such that proper alignment and a secure fit is achieved.

In regards to claims 5 and 6, both Miracky (Fig.12A and par.0095) and Jewell (Figs.10A-C and 16) disclose the use of laser diodes, specifically vertical cavity surface emitting lasers (VCSELs), as the light sources to emit the optical signals from the circuit board. These structures are well known and advantageous for emitting light perpendicular to the circuit board

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surface, as opposed to the more traditional edge-emitting laser diodes. VCSELs are simple to manufacture, with the layers being parallel to the circuit board, and the surface emission does not require further optics to direct the light perpendicular from the circuit board surface. Edge emitting lasers, with their layers parallel to the circuit board, emit light parallel to the board and therefore require additional waveguides and mirrors to direct the light upwards, perpendicular to the circuit board surface. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use VCSELs as the optical signal light source to communicate between stacked, parallel circuit boards.

With respect to claim 8, both references disclose the use of lenses such that the optical signal emitted by the laser diode is properly coupled into the waveguide (Jewell, Fig.19) or directly onto the sensitive site of a photodetector (Miracky, Fig.9A). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a lens in conjunction with the light source to properly couple the optical signal to the waveguide or directly onto the photodetector. In order to avoid optical losses, etc., in sensitive applications such as optical communication systems, lenses are almost universally mated with laser diodes and LEDs in order to collect and properly direct the optical signal for good coupling between devices and waveguides.

With regards to claim 7, both references disclose the use of photodiodes as photodetectors. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use photodiodes because they are easy to integrate into the manufacturing of opto-electronic circuit boards and are quite common and well-characterized devices for detecting optical signals in optical networks, interferometers, etc.

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In regards to claim 10, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have complementary electrical connectors on the circuit boards. This would be required for supplying power to the mezzanine circuit board, for example. PCI cards in computers work the same way. Some of the electrical connectors carry data, and others carry electrical power to run the components on the card.

With respect to claim 11, as shown by Miracky in Fig.12A and by Jewell in Fig.18, the circuit boards have components mounted on the surface. Even by common knowledge, a circuit board has surface mounted devices. Miracky also shows the arrangement such that these surfaces of the circuit boards face one another in parallel. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have components surface mounted on a circuit board and to have these surfaces facing one another. Since data is being transferred by optical means, very few electrical connections, that have to physically connect tightly by frictional means, are required. The parallel arrangement with the surface mounted devices facing one another allows for a more free and easy communication between individual components through the air as shown by Miracky, rather than through electrical connections. If common PCI cards in a PC were arranged as such, they would be difficult to remove, because all the components would be communicating directly with components on the motherboard, which would mean many, tight, frictional connections for the electric signals to pass through.

In regards to claim 12, though Miracky's device shows communication in one direction, from the first circuit board to the second, Jewell discloses a device in Fig.16 that can be mounted on a circuit board, which includes input and output optical devices and associated waveguides. It would have been obvious to one of ordinary skill in the art at the time the invention was made to

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have reciprocal communication abilities between main and mezzanine circuit boards such that the device can function as a true input/output device, such as the well-known PCI card. If the mezzanine circuit board is to expand the capabilities of the main circuit board, then it must have two-way communication means to provide feedback, or results, etc., based upon the input signals from the main board.

With respect to claim 15, both references disclose photodetectors with lenses for focusing an optical signal from the light source to the detector surface (Miracky, Fig.12A; Jewell, Fig.16). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a lens in conjunction with a photodetector such that an improved optical coupling efficiency is achieved.

Regarding claim 16, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 1 would satisfy the method of interconnecting a first and second circuit board adjacent to one another such that an optical signal is transported over a medium from the first board to the second board.

With respect to claim 17, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 12 would satisfy the method of sending an optical signal from the second board to the first board.

In regards to claim 18, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 2 would satisfy the method step of providing free space as the transport medium.

With regards to claim 19, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 3 would satisfy

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the method step of providing a light pipe as a transport medium to guide light from the light source.

With respect to claim 20, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 4 would satisfy the method step of using a ferrule to connect the light pipe in order to guide light from the light source.

In regards to claim 25, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 9 would satisfy the method step of providing a plastic, cylindrical light pipe.

With respect to claims 21 and 22, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claims 5 and 6 would satisfy the method steps of providing a laser diode as the light source, where the laser diode is a VCSEL.

With regards to claim 24, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 8 would satisfy the method step of providing a lens with the light source to focus the light.

With respect to claim 23, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 7 would satisfy the method step of providing a photodiode as a photodetector.

In regards to claim 26, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 10 would satisfy

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the method step of providing for complementary electrical connectors on each circuit board to connect with each other.

With respect to claim 27, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure as applied above against claim 11 would satisfy the method of providing surfaces on the circuit boards for mounting components and a parallel arrangement of the circuit boards such that the mounting surfaces are facing each other.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miracky and Jewell and in view of Husain (US 6,453,083).

In regards to claim 13, the structure as applied above against claim 3 applies here and the following. Miracky discloses lenses being used in conjunction with a light pipe in Fig.14. Though it could be argued that Miracky's light pipe does not "include" the lens, Husain discloses, in Figs. 9B and 10A, the use of lenses formed on the light pipe (in this case, an optical fiber) in order to properly focus the light into or out of the waveguide. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a lens to perform the desired function of properly coupling the optical signal from the light source to the light pipe. Lenses are ubiquitous in the art for optically coupling light between optical devices, an optical device and a waveguide, and between waveguides. Furthermore, the placement of the lens structure on the end of a waveguide allows for a simpler alignment, since the critical distance between the lens and the waveguide is already set by virtue of being formed on the end.

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Conclusion


The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Day (US 6,393,184) discloses an optical link arrangement between circuit boards; Sugama (US 2002/0118907) discloses another optical link arrangement between circuit boards.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas R Artman whose telephone number is (703) 305-0203. The examiner can normally be reached on 8am - 4:30pm Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

October 18, 2002


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